

REMARKS

Applicant expresses appreciation to the Examiner for consideration of the subject patent application. This amendment is in response to the Office Action mailed November 6, 2003. Claim 10 was objected to. Claims 16-23 and 27 were objected to. Claims 1-15 and 24-26 were rejected. The claims have been amended to address the concerns raised by the Examiner.

Claims 1-27 were originally presented. Claims 1-3 and 5-27 remain in the application. The subject matter of Claim 4 has been added to Claim 1. Claim 10 has been amended to correctly conclude the claim, as required in the Office Action. No claims have been added.

The indication of allowable subject matter in claims 16-23 and 27, if rewritten in independent form, is acknowledged with appreciation.

The present invention relates to generating anti-aliased textured and layered fog to thereby render a more accurate image of the fog or similar phenomena in conjunction with the earth when simulating flight at any altitude, but particularly at high altitudes. This can be accomplished, in part, through sampling a plurality of points for each of the adjacent pixels along the boundary of a layered fog region. The points to be sampled are selected over an altitude range with respect to the simulated earth on the display screen, and altitude range corresponds to approximately one pixel height in display screen space. A density value can be generated for each sample point and the density values can be blended using Equation 11 in the specification to thereby form an anti-aliased pixel layered fog density value for each of the adjacent pixels.

Claim Rejections - 35 U.S.C. § 103

Claims 1-27 (including independent claim 1) were rejected under 35 U.S.C. § 103 as being unpatentable over Hollis et al., U.S. Patent Number 6,580,430 B1 (hereinafter "Hollis") in view of Heidrich et al., *Applications of Pixel Textures in Visualization and Realistic Image Synthesis*, ACM Symposium on Interactive 3D Graphics, 1999, pages 127 – 135 (hereinafter "Heidrich").

Claim 1 has been amended to incorporate the subject matter of claim 4.

The Hollis and Heidrich references, when combined, do not teach or suggest all of the elements of claim 1, as amended. Specifically, the Hollis reference does not teach anti-aliasing

by “selecting a plurality of sample points over an altitude range that corresponds to approximately one pixel height in display screen space for each of the adjacent pixels that lie on the boundary of the layered fog regions” and the Heidrich reference does not overcome that deficiency.

The Hollis reference discloses obtaining a pixel color for a pixel and blending a fog color with the pixel color (see Hollis claim 1). “The percentage of fog color blended depends on the fog density, which is a function of the distance from a viewpoint to a quad (2x2 pixels).” (see Hollis column 9, lines 62-64). The Hollis method does not teach selecting a plurality of sample points over an altitude range that corresponds to approximately one pixel height in display screen space. The samples in Hollis are taken at the quad, which is located at the center of the screen (see Hollis Column 12, lines 50-54). Further, the Hollis method does not involve generating a plurality of sample points for each of the adjacent pixels that lie on the boundary of the layered fog regions. In fact, as the office action points out, there are no layered fog regions disclosed in Hollis.

The sample points in the present invention are taken by “generating three layer model samples and blending the samples density values together. The samples will be located over an altitude range that corresponds to approximately one pixel height in screen space.” This is contrary to the Hollis method. The Hollis method cannot be used in the present invention as the present invention must account for a curvature in the horizon due to the simulation of high altitude flight over the earth (see specification page 3, ¶ 3 through page 4, ¶ 2), as additionally claimed in claim 23.

Further, the multiple samples in the present invention are required to prevent aliasing between multiple layers of fog (see page 4, ¶ 5 through page 5, ¶ 1). As previously discussed above, Hollis does not mention layered fog. Hollis does not disclose a method that involves the step of generating a plurality of sample points for each of the adjacent pixels that lie on the boundary of the layered fog regions. Thus, Hollis does not disclose a method for calculating a layered fog density, or for blending the layered fog density.

While Heidrich discusses the concept of layered fog, the article never discloses a method for anti-aliasing the fog layers. The disclosure made in Hollis to anti-alias the single fog layer

would not work to eliminate aliasing at a boundary region between regions of the layered fog that have different densities as in the present invention. Therefore, even when combined, Hollis and Heidrich do not disclose all of the features of the claimed invention, and there is no suggestion in any reference that it would be obvious to modify one reference in view of the other to arrive at the claimed invention. Therefore, rejection of independent claim 1 should be reconsidered and withdrawn.

With respect to dependent claim 2, Hollis does not disclose utilizing three sample points from within each of the adjacent pixels that lie on the boundary of the layered fog. As discussed above, Hollis does not teach layered fog. While Heidrich does disclose the concept of layered fog, the article does not disclose the use of multiple sampling points for each of the adjacent pixels that lie on the boundary of the layered fog. Therefore, there could be no motivation to combine the references to obtain the present invention.

With respect to dependent claim 3, Hollis again does not teach layered fog, or the concept of anti-aliasing between the layers of fog. Nor does Heidrich teach anti-aliasing between the layers of fog. Therefore, neither of the references could teach “selecting the adjacent pixels that lie on the boundary of the layered fog regions”. The purpose of selecting adjacent pixels in the present invention is for anti-aliasing between the layers of fog, which is not taught in either of the references. Therefore, rejection of dependent claim 3 should be reconsidered and withdrawn.

With respect to dependent claim 5, the present invention claims “determining a sample altitude for each of the plurality of sample points.” As taught in the specification and FIG. 2, the sample altitude is found with respect to “World Z”, wherein the sample altitude is the actual height above the simulated ground on the display screen. The “Zs” computed for sampling position in Hollis are “depth Zs” and are all located at the center of the screen in the quad, as discussed previously (see Hollis Column 11, Lines 7-13 and Column 12, lines 50-54). Therefore, rejection of dependent claim 5 should be reconsidered and withdrawn.

Similarly, claims 6-15 and 24-26 are all dependent on claims referring to the use of layered fog. Rejection of the dependent claims 2-15 and 24-26 should be reconsidered and withdrawn for at least the reasons given above with respect to the independent claim. The

dependent claims, being narrower in scope, are allowable for at least the reasons for which the independent claims are allowable.

Claims 16-23 and 27 are objected to as being dependent upon a rejected base claim. However claim 1, as amended, is now in condition for allowance. Therefore, the objection should be reconsidered and withdrawn.

Therefore, Applicant respectfully submits that claims 1-27 are allowable, and urges the Examiner to withdraw the rejection.

CONCLUSION

In light of the above, Applicant respectfully submits that pending claims 1-27 are now in condition for allowance. Therefore, Applicant requests that the rejections and objections be withdrawn, and that the claims be allowed and passed to issue. If any impediment to the allowance of these claims remains after entry of this Amendment, the Examiner is strongly encouraged to call Steve Perry at (801) 566-6633 so that such matters may be resolved as expeditiously as possible.

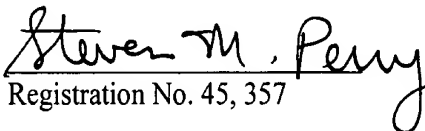
No claims were added. Therefore, no additional fee is due.

The Commissioner is hereby authorized to charge any additional fee or to credit any overpayment in connection with this Amendment to Deposit Account No. 20-0100.

DATED this 6th day of February, 2004.

Respectfully submitted,

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